

# CALiPER

*COMMERCIALLY AVAILABLE LED PRODUCT EVALUATION AND REPORTING PROGRAM*

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**Market Introduction Workshop**

Pittsburgh, PA

July 17, 2012

**CALiPER evolution**

**CALiPER process**

**Product performance**

**Next steps**

**How to use CALiPER reports and data**

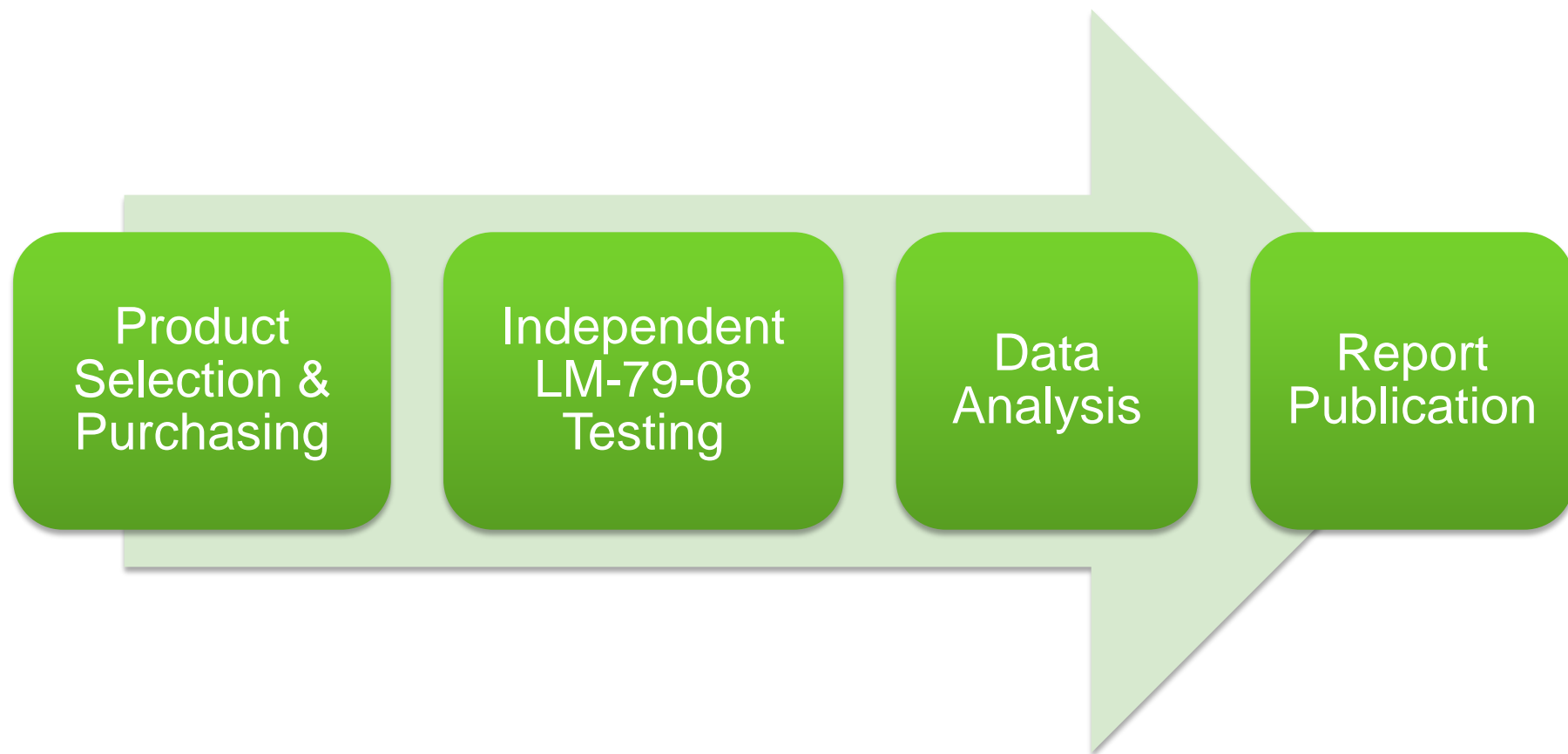
- CALiPER started in the SSL ‘Wild Wild West’
  - No LM-79 test procedures
  - Little understanding of how to compare products
  - Many low efficacy products with even lower light output
  - Virtually no industry accountability
  - False equivalency claims by many
  - Potential for great consumer disappointment
  
- 2012 – Entirely different story!

## Historically:

- Capture market trends and gauge performance levels
- Improve manufacturer accountability
- Inspire consumer confidence

## New Emphasis:

- Identify important areas for improvement
- Educate industry on potential issues
- Support standards activities



## **I. Industry observations**

- Website searches – eLumit, DLC, LEDs magazine etc.
- Trade publications, popular media
- Manufacturer marketing materials
- Conventions, trade shows, and conferences
- National retailers

## **II. LED Lighting Facts quality assurance concerns**

- Do reported values reflect commercially available products?

## **III. CALiPER guidance committee**

**Manufacturers can't request tests or submit products.**

# Step 1: Selection Criteria

- **Determine area of focus**
- **Select benchmark products**
- **Select products for reasonable comparisons**
  - **Lumen package**
  - **Color temperature**
  - **Color rendition**
  - **Product availability**
  - **Energy efficiency programs**

## Step 2: SSL Luminaire Testing

- Independent testing laboratories
- Uses *absolute photometry* rather than *relative photometry* (IES LM-79-08)
  - Must measure luminaire as a complete system
- Benchmark products for each application are also tested to LM-79
- Integrating sphere and goniophotometer testing



Photo credit: Luminaire Testing Laboratory

# Step 3: Data Analysis

## Key questions to answer:

- **Does the product perform as claimed?**
  - Marketing literature (equivalency and performance claims)
  - Specification sheets (at the time of the order)
  - Product packaging
- **Does the product perform as expected?**
  - What are you replacing?
  - What are you trying to accomplish?
  - How does the SSL product compare to conventional alternatives?



- **2006** Pilot phase
  - 4 products (hard to purchase)
- **2007** Rounds 1-3
  - Small replacement lamps, desk lamps, undercabinet, small downlights
- **2008** Rounds 4-6
  - Downlight and T8 in situ testing, replacement lamps
- **2009** Rounds 7-9
  - Streetlights, bollards, downlights, 2x2 panels, 2x4 troffers, replacement lamps
- **2010** Rounds 10, 11
  - Parking garage, wallpack, cove lights, replacement lamps, roadway, high-bay
- **2011** Rounds 12, 13
  - Downlights, track lights, A-lamps, T8 replacements, cove lights, high-bays, wall packs, 2x2 troffers

# Upcoming Testing



Released  
this year

Downlight Retrofits (New Format)  
Retail Replacement Lamps 2 (Special)  
Floodlights  
BR30s

AR111, PAR38  
Linear pendants  
Wall washers

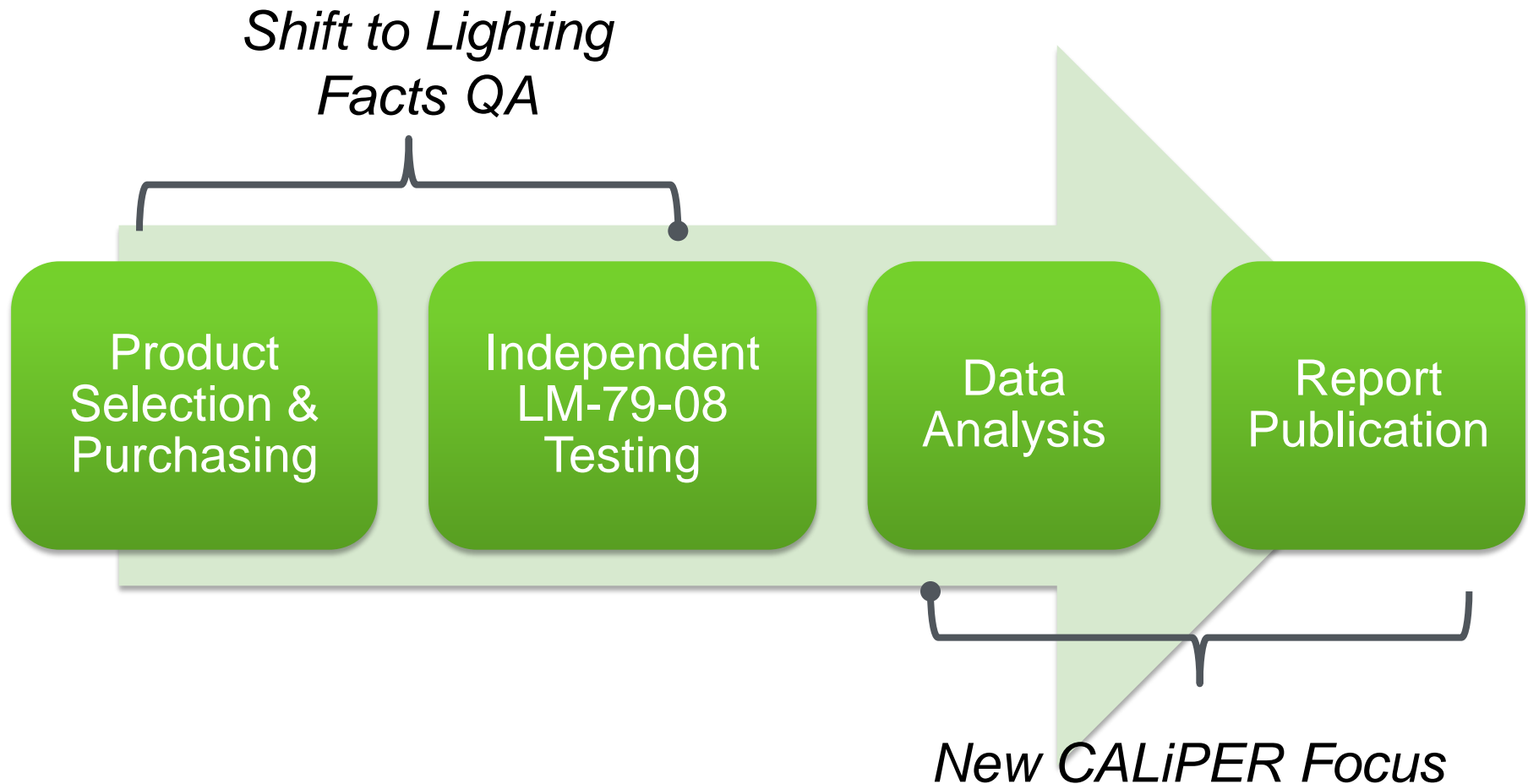
Still to  
come



2013

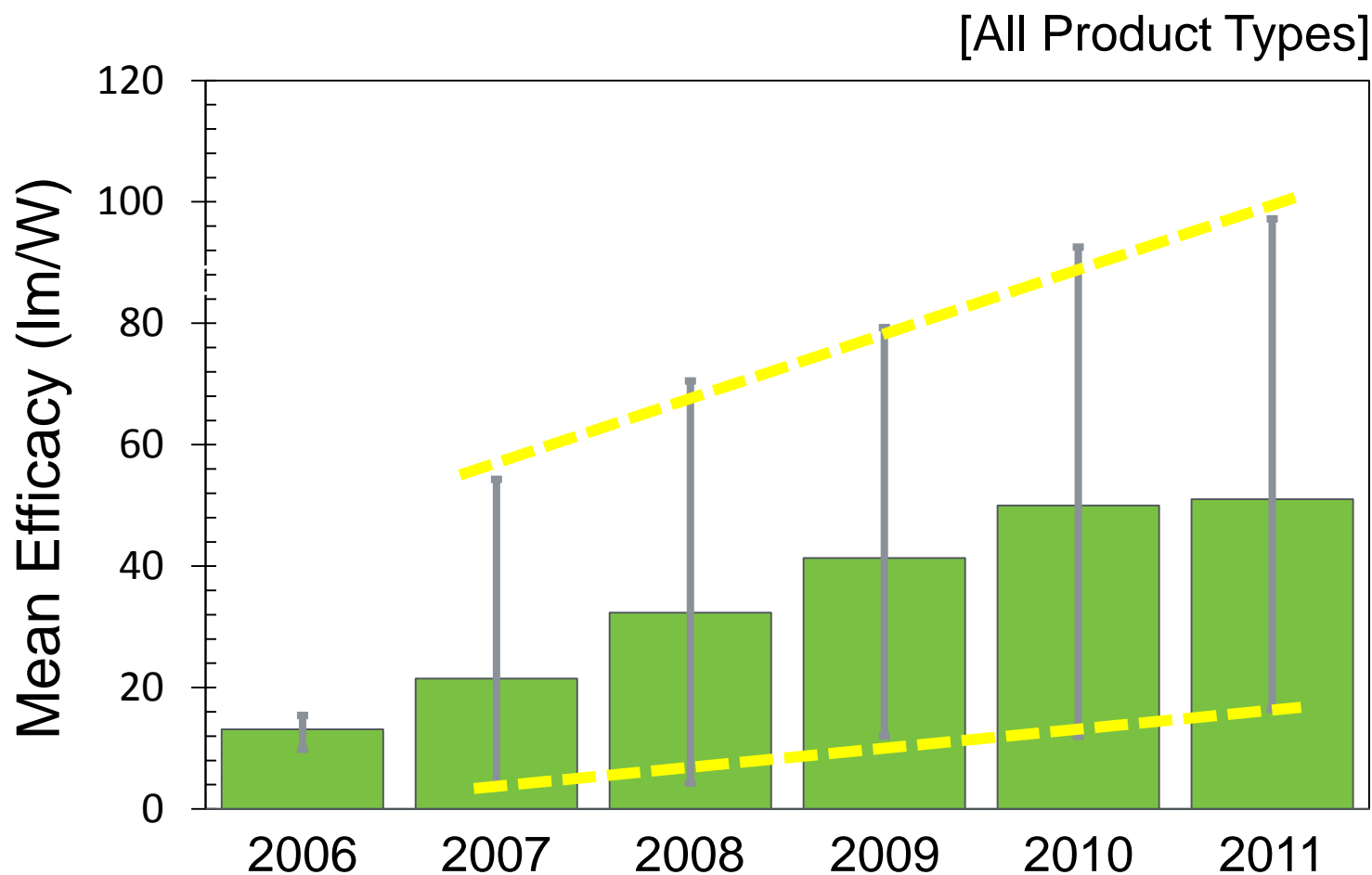
High-output A-lamps  
Troffers (2x4s, 2x2s)  
T-8 Replacements

- **Overall improvements in light output, efficacy, light distribution, power factor, color quality**
- **Manufacturer claims are improving (LED Lighting Facts label helps) but equivalency claims can still be a problem**
- **Suitability often depends on application**
  - Comparable products are now found in many lighting applications
  - Poor performing products are also found
- **Careful comparisons based on accurate performance data is an absolute necessity**
- **Be cognizant of “secondary” quality issues: glare, flicker, color tolerances, physical formats, reliability...**

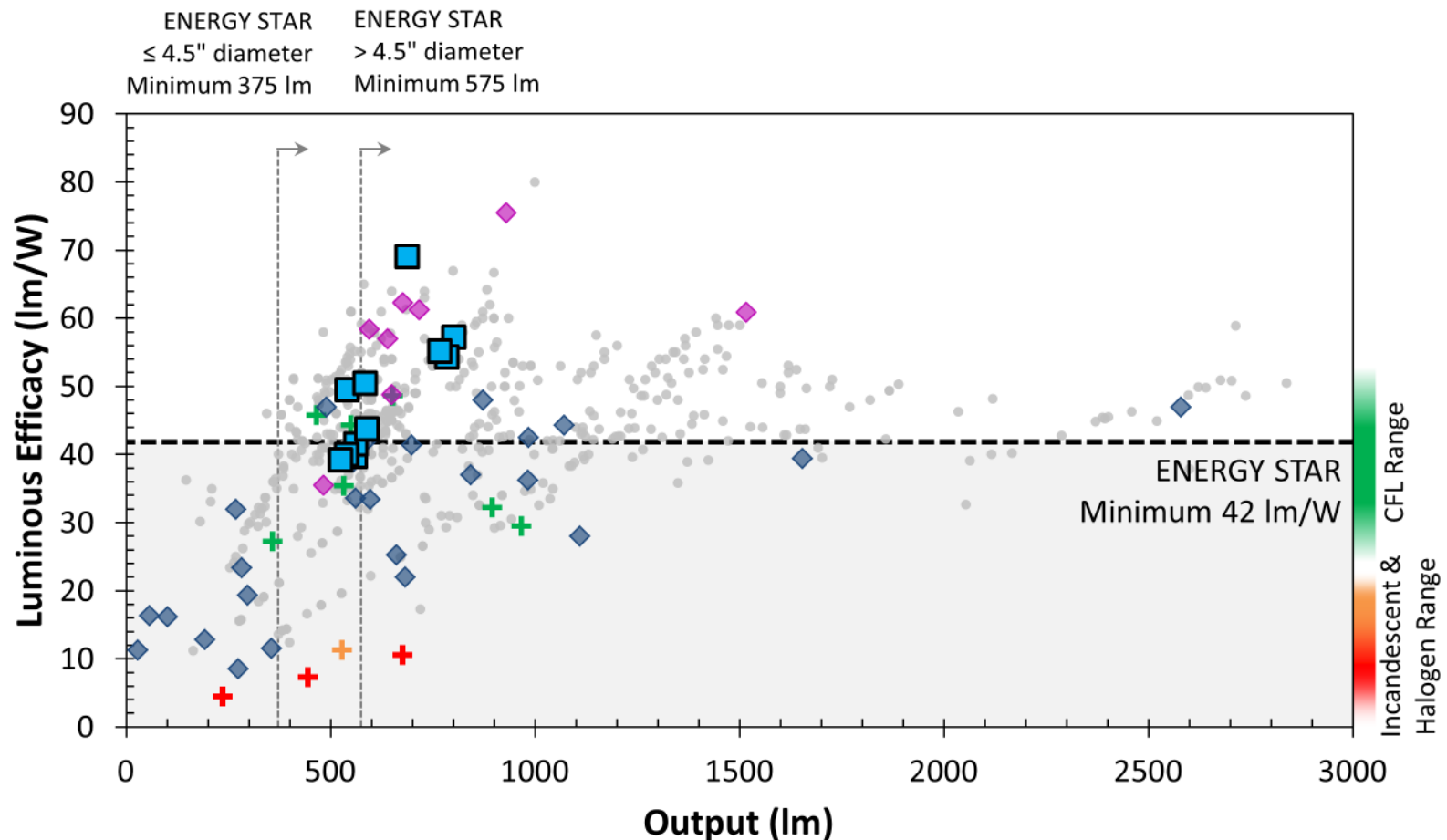


- **Industry ‘snap shots’ using LF data**
- **Application reports**
  - **New focus on specific applications and design scenarios**
- **Special Investigations**
  - **Expands application reports to incorporate product installations and evaluations**
- **Standards Support**
  - **Flicker, dimming, power quality testing**

- **Summary reports**
  - Overall trends
  - Special considerations for focus application
    - Light output
    - Distribution
    - Color
  - LM-79 testing of benchmark products
- **Detailed reports**
  - Complete LM-79 report information online
  - Manufacturer claims for comparison



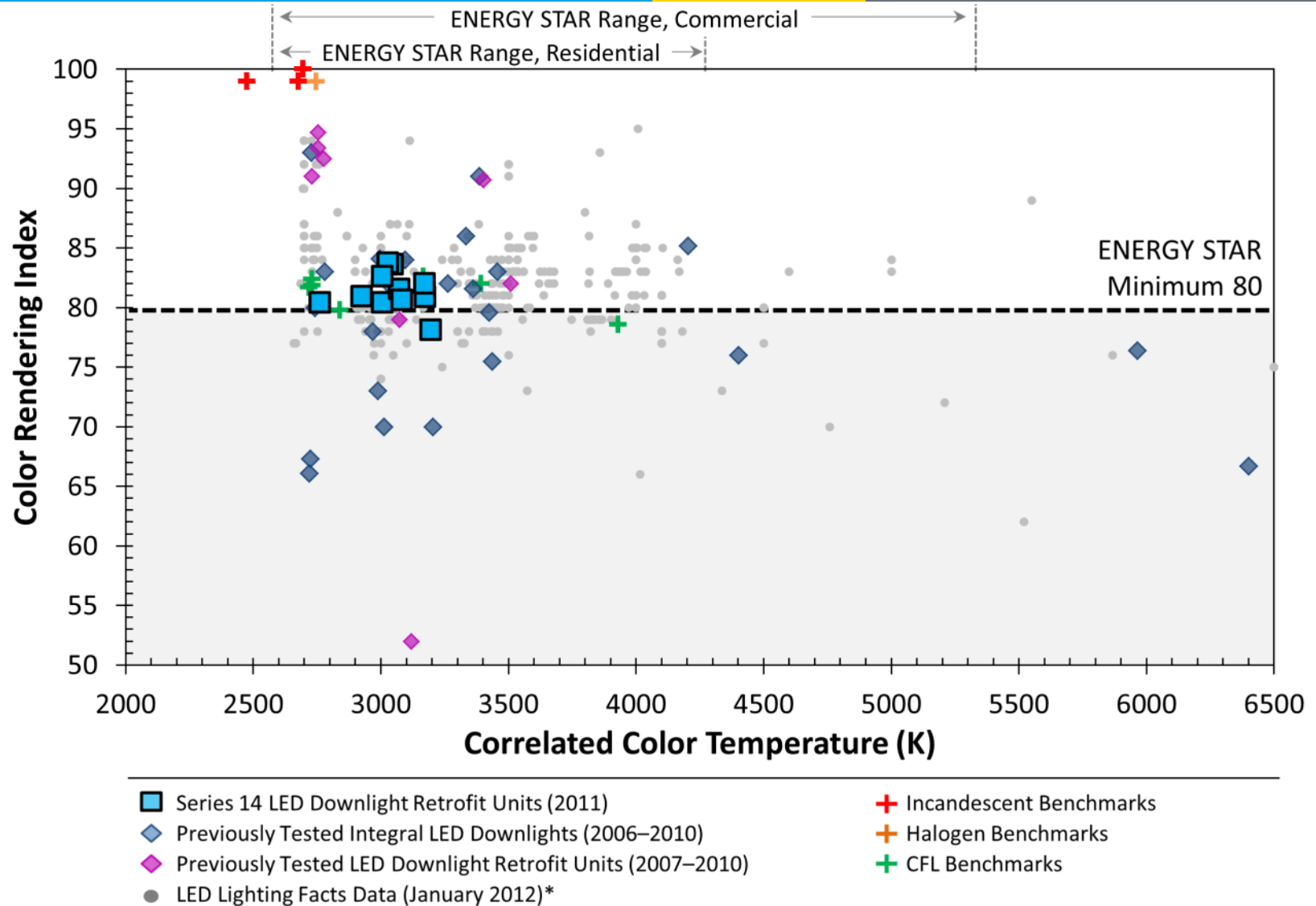
# Overall Trends - Efficacy



- Series 14 LED Downlight Retrofit Units (2011)
- ◆ Previously Tested Integral LED Downlights (2006–2010)
- ◆ Previously Tested LED Downlight Retrofit Units (2007–2010)
- LED Lighting Facts Data (January 2012)\*
- + Incandescent Benchmarks
- + Halogen Benchmarks
- + CFL Benchmarks

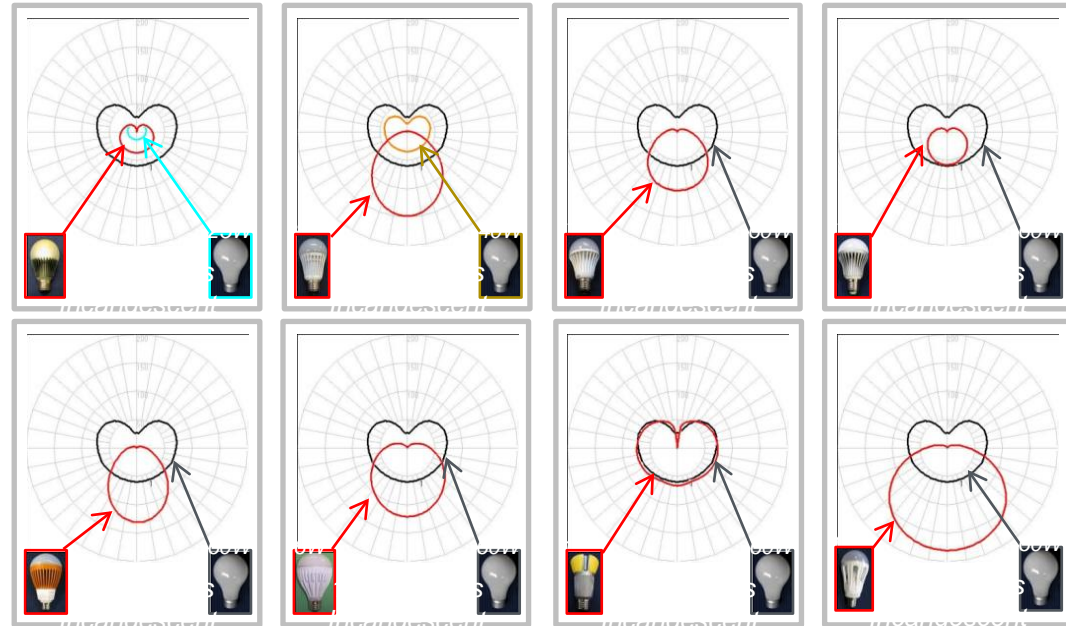
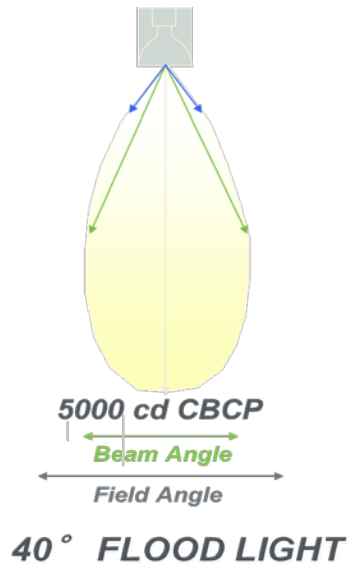
\*Includes both LED downlight retrofit units and integral LED downlights.

# Overall Trends - Color



\*Includes both LED downlight retrofit units and integral LED downlights.

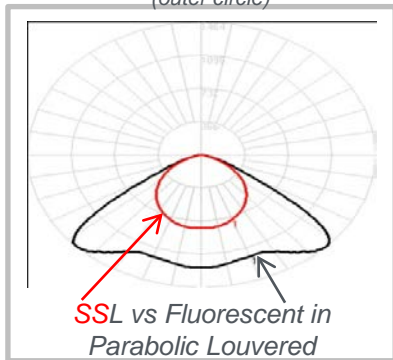
# Comparing Distributions



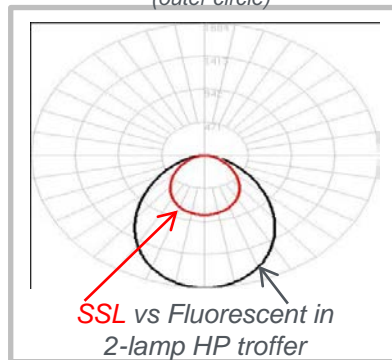
**A-lamps**

## T-8 Replacements

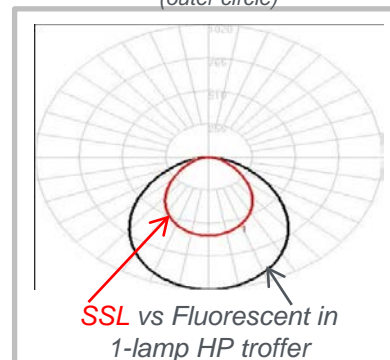
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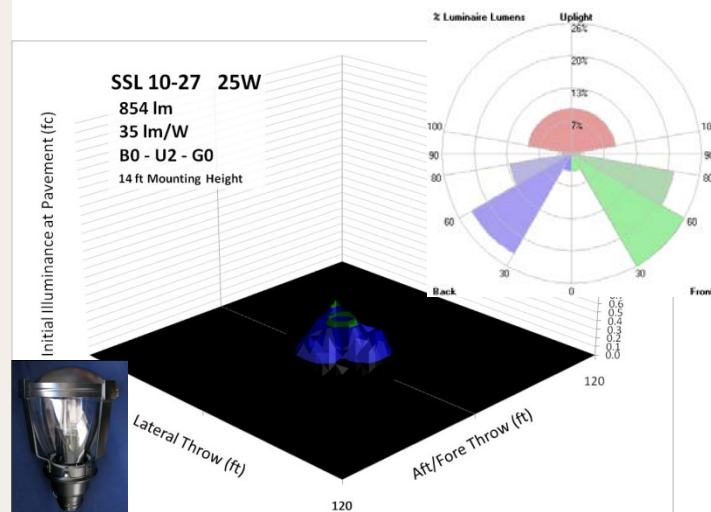
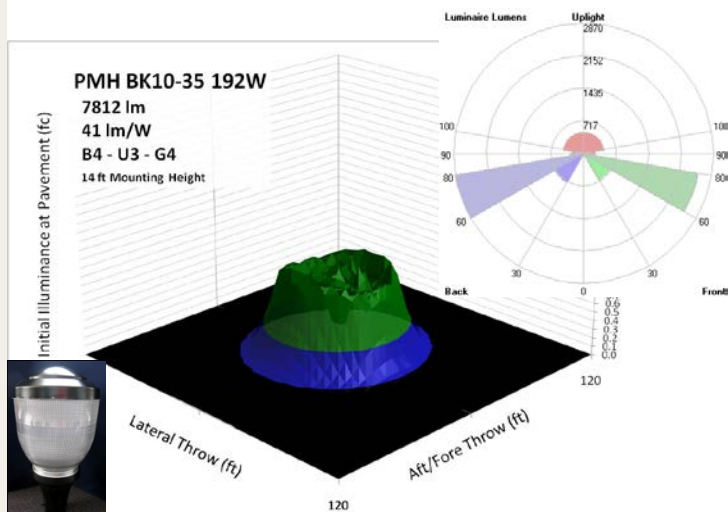
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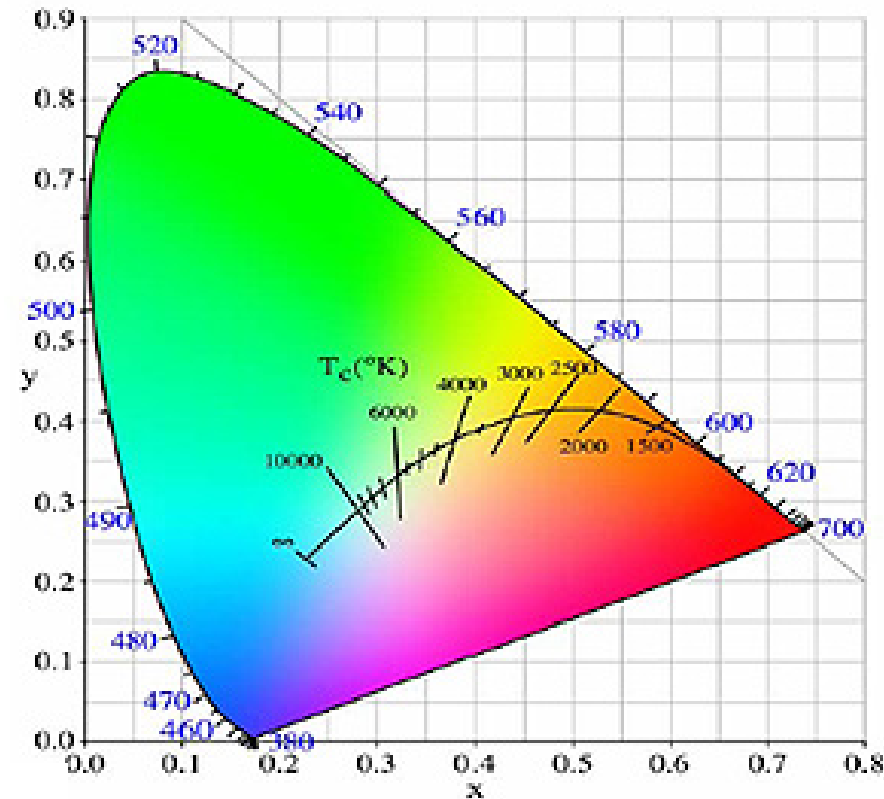
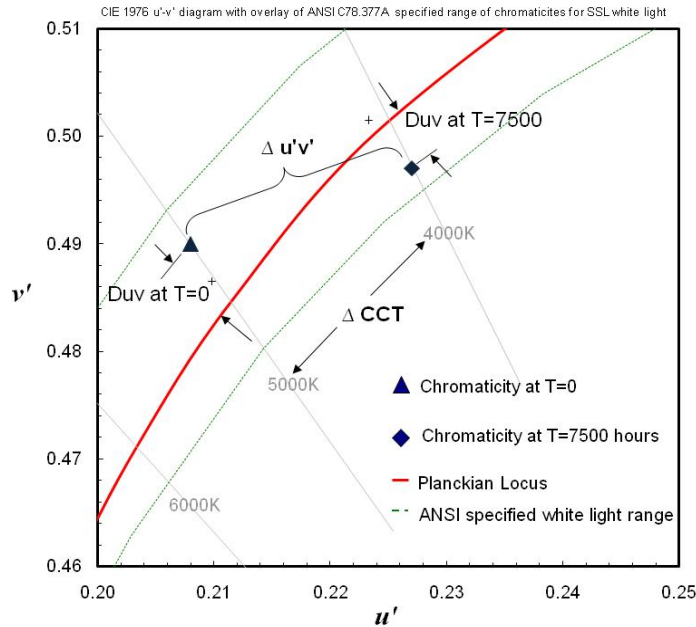
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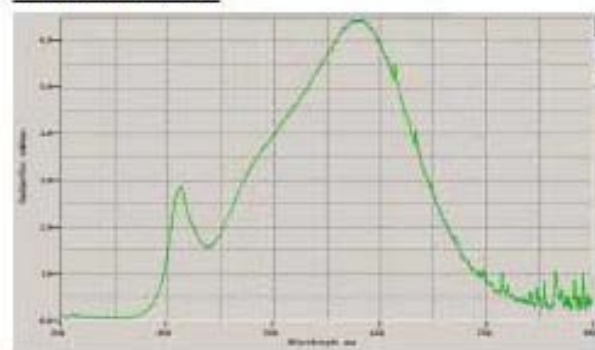
# BENCHMARKS



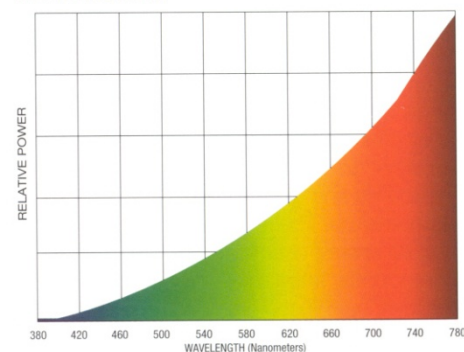
# Understanding Color

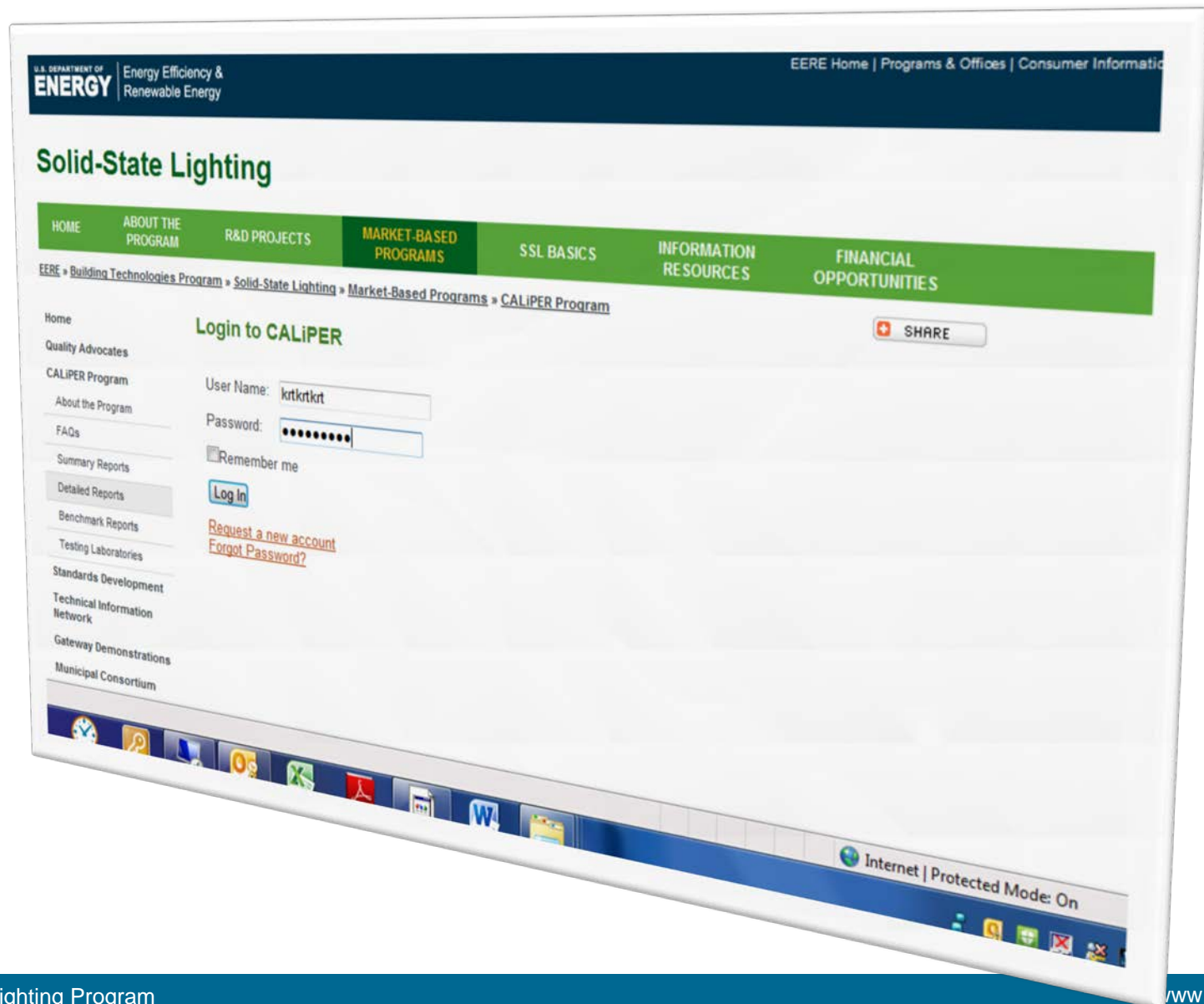


**Spectral Power Distribution Curve**  
CALIPER 09-49-01A



**Incandescent**





The screenshot displays the 'Solid-State Lighting' section of the U.S. Department of Energy's Energy Efficiency & Renewable Energy website. The page features a green navigation bar with links: HOME, ABOUT THE PROGRAM, R&D PROJECTS, MARKET-BASED PROGRAMS (highlighted), SSL BASICS, INFORMATION RESOURCES, and FINANCIAL OPPORTUNITIES. Below this, a breadcrumb trail reads: EERE » Building Technologies Program » Solid-State Lighting » Market-Based Programs » CALiPER Program. A sidebar on the left lists various program components, with 'Detailed Reports' selected. The main content area is titled 'Category Search' and includes a search instruction: 'Search using any or all data fields, for a comparative listing of information from CALiPER detailed reports. Multiple selections are allowed within round number and category fields.' The search interface contains several input fields: a 'Category' dropdown menu with options like All, Cove, Downlight (selected), Outdoor Area - Post Top, Outdoor Area - Roadway, and Outdoor Bollard; a 'Test Date From' field set to 7/28/2006; a 'CCT Range From' field; a 'Sort By' dropdown; a 'Round #' dropdown menu with options All, 13, 12 (selected), 11, 10, and 9; and date fields for 'To:' (set to 11/10/2011) and another 'To:' field. A 'Search' button is at the bottom left, and a 'Reset' button is at the bottom center. A 'SHARE' button is located in the top right of the search area. The user is logged in as 'krtkrt' with links for 'Change Password' and 'Logout'.

U.S. DEPARTMENT OF  
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## Solid-State Lighting

HOME ABOUT THE PROGRAM R&D PROJECTS **MARKET-BASED PROGRAMS** SSL BASICS INFORMATION RESOURCES FINANCIAL OPPORTUNITIES

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Municipal Consortium

### Category Search

Search using any or all data fields, for a comparative listing of information from CALiPER detailed reports. Multiple selections are allowed within round number and category fields.

Category: All Cove Downlight Outdoor Area - Post Top Outdoor Area - Roadway Outdoor Bollard

Test Date From: 7/28/2006 (mm/dd/yyyy)

CCT Range From: (mm/dd/yyyy)

Sort By: --

Round #: All 13 12 11 10 9

To: 11/10/2011 (mm/dd/yyyy)

To: (mm/dd/yyyy)

Search

Reset

SHARE

Logged in as: krtkrt | Change Password | Logout

# Detailed Reports

CALiPER RESULTS			MANUFACTURER CLAIMS		
Power	10.2	W	Manufacturer Power	10.0	W
Voltage	120	V AC	Manufacturer Voltage	120	V
Current	0.10	A			
Power Factor	0.87				
Light Output	596	lm	Manufacturer Light Output	575.0	lm
Efficacy	58.5	lm/W	Manufacturer Efficacy	55.0	lm/W
CCT	2776	K	Manufacturer CCT	2700	K
CRI	93		Manufacturer CRI	90	
Duv	0.000				
CBCP	322	candela	Manufacturer CBCP		
Beam Angle	83	degrees	Manufacturer Beam Angle	328	candela
Field Angle	130	degrees			degrees
92 Lighting Facts					
ADDITIONAL MANUFACTURER DESCRIPTIONS OF PRODUCT					
Manufacturer Life	"Designed to last 50,000 hours... Five Year Warranty" on spec sheet "35,000 hours...3 year warranty" on box				
Manufacturer Equivalency Claim	"65 Watt Equivalent Bulb" on packaging				
Manufacturer Luminaire Efficiency	"Cree TrueWhite Technology"				
Lamp Description	"ENERGY STAR® qualified Solid-State Lighting Luminaire."				
Lamp Performance	Dimmable to 5%				
Driver-Ballast Description					
Ballast Factor					
Other Manufacturer Claims					
Dimmability					

# Questions?

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